

I-680 SMART LANE PROJECT SYSTEM ENGINEERING MANAGEMENT PLAN

SYSTEM INTEGRATION PLAN GUIDELINES

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1. GENERAL

This document presents the I-680 Smart Lane (Smart Lane) Electronic Toll System (ETS) equipment and System Integration Plan (Integration Plan) guidelines. The Integration Plan shall define the activities necessary to integrate the ETS functional software components into the complete ETS software application system.

The Integration Plan shall contain an overview of the system and a description of the major tasks involved in the integration, including the overall Integrator resources that are needed to fully support the integration effort.

The Integration Plan shall be developed by the ETS System Integrator (Integrator) during the system development phase and should be updated during the Integration and Test Phase; the final version would be provided in the Implementation Phase for approval by the JPA. The Plan will outline the different types of software integration tests that shall be conducted to ensure that the ETS is designed and operates according to the RFP and the other Contract documents. These integration tests are internal tests to be conducted by the Integrator and, therefore, are separate from the Smart Lane tests that will be performed by the JPA as identified in the Verification (Test) Plan. The Plan will also identify the roles and responsibilities of each Integrator internal group that will be working on this project.

2. ROLES AND RESPONSIBILITIES

To ensure that the delivered tolling system operates according to the Smart Lane RFP and the other Contract requirements, many parts of the Smart Lane project engineering organization will have various roles and responsibilities. Listed below are suggested starting points for defining organizational responsibilities pertaining to the system integration activities that are required to ensure program success.

2.1 Joint Powers Authority (JPA) Personnel

The JPA Executive Director (ED) shall have full contractual responsibility for all of the Smart Lane equipment and system integration activities and will work closely with the Consultant staff to ensure that the ETS integration is accomplished properly. The JPA shall review and approve the Integration Plan prior to its use by the Integrator.

2.2 Project Consultant Staff

The Smart Lane tolling system consultant staff shall have the following roles and responsibilities:

1. Review and provide comments on the Integration Plan and all ETS integration methods, integration test plans and procedures, integration schedule, policies and validation procedures for the Smart Lane Project.
2. Participate in all facets of integration activities and provide recommendations to the JPA for verification testing during integration stages of the project.
3. Provide technical assistance to the Integrator and JPA staff during the integration process.
4. Provide guidance during Integration with live traffic in conjunction with the JPA management staff.
5. Maintain a liaison with JPA and Integrator staff to incorporate additional Integration testing procedures and additional operational scenario management based on external requirements

2.3 Integrator Systems Engineering Staff

The Integrator systems engineering personnel for the Smart Lane Project shall have the following roles and responsibilities:

1. Develop a comprehensive Integration Plan that is required to effectively support the Smart Lane ETS Application system. The Plan shall be approved by the JPA.

2. Perform all Integration tests described in the plan including performance requirements and detailing to the JPA/Consultant group each procedure that is being conducted and why.
3. Ensure that the sub-system and end-to-end integration testing requirements and processes satisfy the RFP requirements by utilizing the trace matrix.
4. Develop a detailed integration report that identifies all of the integration tests that were run, any problems that were discovered and how those problems would be corrected.
5. Perform any required re-integration activities that are identified by JPA and Consultant staff. Re-integration documentation shall be submitted to the JPA.

3. SYSTEM INTEGRATION PHASES

The Smart Lane ETS Integration Plan shall contain details to reflect a phased integration process to accommodate the various sub-systems that constitute the ETS application system.

The System Integration Plan shall clearly identify the following phases:

- Phase 1 - Field Sub-systems Integration;
- Phase 2 – Toll Data Center (TDC) System Integration;
- Phase 3 - Communications System Integration; and
- Phase 4 – End-to-End Application Integration.

Presented below in Figure 1 is a schematic that shows the distinct Smart Lane Project ETS integration phases and how each phase inter-relates with one another.

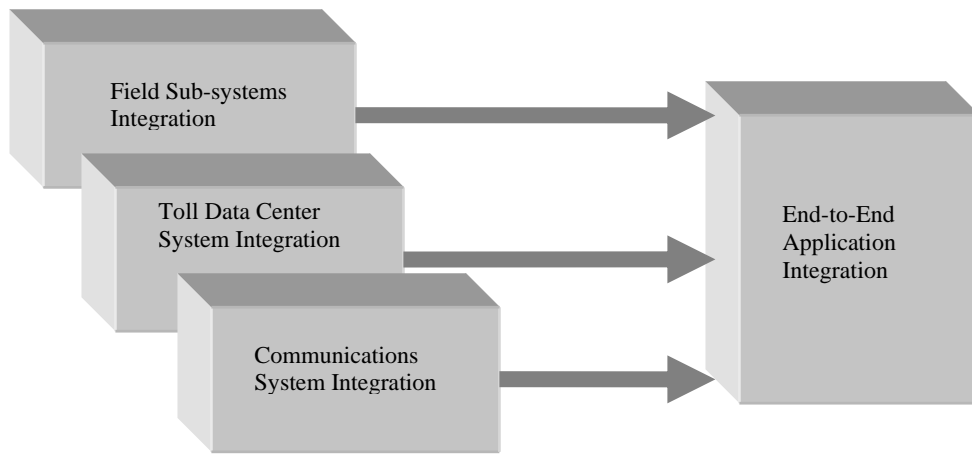


Figure 1 – Integration Process

3.1 Field Sub-systems Integration

The Integration Plan shall define in detail the integration of each of the field sub-systems which comprise the Smart Lane tolling solution. This would include, at a minimum:

1. The electronic tolling system;
2. The Dynamic Message Sign (DMS) system;
3. The Vehicle Detection Station (VDS) system; and
4. The Smart Lane enforcement system;
5. The Closed Circuit Television (CCTV) system.

The Integrator sub-system integration tests should include, at a minimum, the following test environments to satisfy the capabilities identified in the RFP functional requirements and other Contract documents:

- Verify data integrity (no loss of data);
- Verify diagnostic messages;
- Introduce failures and threats;
- Degraded mode performance;
- Verify diagnostic messages; and
- Normal transaction tests.

3.2 Toll Data Center (TDC) System Integration

The Integration Plan shall define in detail the integration of each of the TDC sub-systems which are part of the Smart Lane tolling solution. This would include, at a minimum;

- Customer Service Representative (CSR) workstations;
- Management workstations;
- Dynamic pricing application servers;
- ETS application servers;
- Network components;
- Interface to the Caltrans Traffic Management Center (TMC);
- Interface to the BATA Regional Customer Service Center (RCSC);
- Interface to the Smart Lane enforcement sub-systems;
- JPA website; and
- Device monitoring and control devices.

The following internal Integrator integration tests, at a minimum, should be identified in the Integration Plan:

- Verify diagnostic messages;
- Normal transaction tests;
- Tolling zone operational tests;
- TDC trip generation and algorithm process;
- TDC interface to the BATA RCSC;
- TDC interface to the Caltrans TMC;
- TDC interface to the enforcement sub-system; and
- Proper association of vehicle and transponder.

3.3 Communications System Integration

The Integration Plan shall define in detail the full integration of the entire communications system in support of the Smart Lane solution. This would include, at a minimum:

- Roadside communications, including the wired and wireless communication links;
- TDC to tolling zone communications, which includes the wired links;
- TDC to the VDSs that are not connected directly through one of the tolling zones, which includes wired links;
- TDC to the BATA RCSC;
- TDC to the Caltrans TMC; and
- TDC to the enforcement sub-systems.

The following, at a minimum, internal Integrator communications system integration tests should be identified in the Integration Plan:

- Reliability of connectivity tests;
- Communications data throughput tests;
- Communications error handling tests; and
- Tests to verify communications recovery processes for both wireless and wire line environments.

3.4 End-to-End Application Integration

The Integration Plan shall define in detail the integration of each of the sub-systems to the others thus constituting an end-to-end Smart Lane solution. The plan will detail each of the Integration tests that would address the integration of all of the sub-systems in a structured manner to achieve the desired outcome of the Smart Lane application.

- Operation of the TDC, including the dynamic pricing algorithms and the trip generation process;
- Interface to the Caltrans TMC; and
- Integration between the TDC and the BATA RCSC (RCSC).

4. INTEGRATION PLAN COMPONENTS

The basic Integration Plan to be developed by the Integrator shall contain a series of activities and tasks to be executed as part of the System Integration Phase.

Integration testing activities and scenarios during these tests shall include complete end-to-end testing of all functions and operations of the Smart Lane System. This integration testing will involve live traffic in the Smart Lane, both real traffic and test vehicles.

4.1 Integration Tasks

The following System Integration Tasks would be identified in the Integration Plan for the Smart Lane ETS application system. These tasks would be carried out on all detail ETS Integration Phases and associated Integration Tests. The System Integration Plan shall describe these tasks in detail to provide a comprehensive audit of the ETS integration phase of the Smart Lane Project.

1. Provide overall planning and coordination Integrator activities of the ETS application integration;
2. Provide appropriate training for personnel to carry out the integration;
3. Provide appropriate documentation on each sub-system for integration;
4. Provide audit or review reports;
5. Document sub-system software unit and database;

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6. Establish integration test procedures;
7. Conduct sub-system integration testing; and
8. Integrate sub-systems into final Smart Lane ETS application system.

The JPA and their representatives shall be permitted to participate in or otherwise observe any and all of these Integration Tasks. Tentative dates for conducting the various Integration phases shall be included in the Integration Plan document that shall be submitted by the Integrator during the system design phase of the Contract. Reasonable modifications to these dates may be permitted during the course of the work by the JPA provided a written request for such change is made at least two (2) weeks prior to the revised Integration Phase test date. The actual change approval must be granted, in writing, by the JPA.

4.2 Activities Related to Tasks

This section of the Integration Plan shall provide a detailed description of each major Integrator task that is required for the full integration of the tolling system. The Integrator will also develop an internal integration schedule for when these tasks are expected to be completed.

The following information shall be included in the description of each major task, as appropriate:

1. What the task will accomplish;
2. Resources required to accomplish the task;
3. Key person(s) responsible for the task; and
4. Criteria for successful completion of the task.

Task Accomplishment

This sub-section of the Integration Plan shall consist of a detailed description of the expected results of each of the integration tasks to be carried out by the ETS Integrator to complete the Smart Lane System application

Resource Requirements

This section of the Integration Plan shall contain project developed equipment and software products to be integrated, including any support equipment such as special software, test hardware, software drivers and test stubs to simulate sub-systems to be integrated during the system integration phase.

Key Integration Staff

This section shall identify the key system integration specialists, including the external system interface knowledge engineers to enable successful integration of major sub-systems of the ETS application system.

Criteria for Task Completion

The Integration Plan shall provide both the Integrator and the JPA a mechanism for verifying and documenting successful integration of all the sub-systems throughout the integration testing. Testing procedures and scenarios, which will be developed by the Integrator and subject to JPA approval, shall be built upon the previously utilized Unit and Sub-system scripts and test steps.

5. INTEGRATION SUPPORT

The System Integration Plan shall describe the support software, materials, equipment, and facilities required for the integration, as well as the personnel requirements and training necessary for the Smart Lane application integration.

Resources and their Allocation

The plan shall list all support software, materials, equipment, and facilities required for the end-to-end Smart Lane application integration. The Integration Plan shall describe the test environment and any resources needed. The Plan shall describe the number of personnel needed and availability.

Training

The Integration Plan shall identify the training necessary to prepare for the integration and maintenance of the Smart Lane application system.

Testing

The Integration Plan shall list all the test requirements for each set of integration test scenarios. It should include a description for each suite of integration tests. This shall include descriptions of the data included, procedures for testing, who is responsible for the testing and a schedule. This could be accomplished in one plan or several depending on the complexity of the suite of integration tests being tested.

Any failures that are encountered during the integration testing must be resolved and re-tested before commencement of the Operational Performance Test (OPT), which is described in the Verification (Test) Plan. The integration problems that are identified will be tracked by the Integrator and the matrix shall be provided to the JPA, if requested.

I-680 Smart Lane Project – System Integration Plan Guidelines
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I-680 Smart Lane Project Document Revision History		
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Approval Person	Signature	Date